

AVIATION

The Oldest American Aeronautical Magazine

DECEMBER 13, 1926

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A Ryan M-1 being delivered to Colorado Airways. (The new San Diego Airport below.)

VOLUME
XXI

SPECIAL FEATURES

NUMBER
24

AN ECONOMY CHART FOR AIRPLANES
AIRPLANES AND PRIVATE FLYING
AIR MAIL STATISTICS SHOW INCREASED SERVICE

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The "Round-Europe Flight"



On May 26th, 1936, Capt. Vilém Stanovsky, Pilot, and Mr. J. Staněk, Mechanic, began a flight, covering in 21 days 11,000 miles. Their plane was a four-engine "Aero A-12" powered by a "Twin II" engine built by the Bristol, Sons & Company, Prague.

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quality of your Gasparde Mobiloil." Since the inception of the company, The Aero Airplane Works, producers of the plane, have used Gasparde Mobiloil for their test and development work—a practice followed by the majority of airplane manufacturers throughout the United States.

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Vol. XXI

DECEMBER 13, 1926

No. 24

The Press and Aeronautics

THERE is no subject on which the average flyer will grow more satisfied than in discussing the manner in which the press treats an aviation accident. The flyer feels that accidents are given rather prominence and that, in playing up airplane crashes, the newspapers are showing a deep prejudice against aviation. When a newspaper prints a forced landing as an "18-CAPER FROM DEATH WHEN PLANE FALLS 200 FT.", most flyers reach the bottom point and, if talk could kill, the city editor's job would be much more dangerous than that of the flyer.

There is some justification in the pilot's attitude, but he is wrong when he feels that the daily press, as a whole, is prejudiced against aviation. Much of the interest in aviation in the press which may seem to be written with antagonism is really the result of ignorance in aeronautical matters, and the natural result of being forced to create news which will appeal to the public. Furthermore, it must not be overlooked that airplane accidents are in reality far less common than are automobile accidents and this fact alone goes, to the newspaper editor, to enhance their news value. In fact it may reasonably be said that positive airplane accidents are somewhat rare.

The metropolitan press devotes a great deal of space to aeronautics. The guarantee which was given the news of the Round-the-World Flight of the Army Air Corps undoubtedly had a very considerable bearing upon the greatly increased space taken up in aeronautics which was evident last year. The newspapers have all space given all the space that has been deemed to be news of the National Air Races particularly in recent years, and new speed and endurance records are almost constantly featured. The magazine writers of the papers cover such interesting aeronautical articles.

There is a further aspect to this alleged subject. As already mentioned, it is true that aviation accidents are sometimes given more prominence than an automobile accident, but, apart from the latter being far more common than the former, automobile accidents are usually much less spectacular than are airplane accidents. In exactly the same way, when an automobile establishes a new time-record for the road the news is carried in the automobile section but when an airplane flies to the moon and establishes a new quick for speed or for endurance the story about it gets a place on the front pages of the newspapers. The event is inherently spectacular.

The larger daily newspapers, in almost every case, now have aeronautical correspondents whose stories are frequently as accurate and reliable as information as any articles carried in the daily press. It is up to flyers and all aeronautical people, especially in the smaller communities, to cooperate with the press and try to impart to it some real aeronautical knowledge. The ar-

rogue reporter is really anxious to get the facts but getting the facts accurately and writing them up so as to please them in at the last moment is a paper game to press is a different matter. The newspapers exert a great influence on public opinion and it should be part of the business of every one possessing an accurate knowledge of aeronautics to see that the press gets the straight dope and that aviation gets fair treatment.

The Demand for Commercial Engines

THERE is little doubt that, during the past year or so, there has been a considerable change for the better in aviation aeronautics in this country. The businessman has become a fixed line operator; he is using business methods and has tangible property and sometimes money in the bank. Airports are rapidly increasing in number and air transport lines have been established. Civilian aeronautics has become established so that the manufacturer of aeronautical products can count on a fairly definite demand and if the product is satisfactory the demand will be continuous and increase in volume.

That conditions of civilian airplanes are supplying this demand adequately, there is no doubt but in the matter of engines this is not altogether true. The engine is really the most important part of the airplane and with the increasing development of various classes of commercial planes, the demand for specialized power classes of commercial engines will grow.

Although the supply of war airplane engines is not exhausted the possibility of a security are already in sight. Furthermore, there has been only one surplus engine which has really been found suitable to serve as commercial engine and civil service, whereas there is already a growing need for other types of engines.

The development of an engine requires a large outlay in experimental costs and the ultimate demand for an engine can be reasonably foreseen, the expense is not altogether warranted. Yet from the financial point of view there is probably no section of the commercial aeronautical manufacturing field which offers greater certainty than that of the production of engines for civilian machines. The production of commercial engines is somewhat speculative knowledge as it is not a question of enormous production as in the case of the automobile engine, nor is it possible or desirable to put into the production of commercial engines the same overhead figures which are demanded in the case of the military engine owing to the economy of wartime aircraft to make such machines. Those who are now considering specifications in the manufacture of civilian engines are entering into a field which has many difficulties but which is so fundamentally important and in which the demand is so desirable that their future depends only on their ability.

An Economy Chart for Airplanes

Effect of Wing Area on Speed, Economy and Speed Range Shown Diagrammatically

By PROF. C. H. POWELL

Faculty of Aeronautics Dept. University of Toronto

IN SCIENTIFIC investigation of any sort it is frequently found that certain variables are independent variables at a time and determine an effect while keeping all the rest fixed. It is in the same principle which is effectively applied in the tuning of any engine for example. It is not easy to vary just the cause of an effect when a multitude of things are adjustment are made simultaneously.

In the chart about to be described, the performance factors of an airplane are investigated for changes in wing area only, all the other factors such as fuselage weight and resistance are supposed to be kept constant. At the same time, it is the object to indicate, in a general manner, the effect of change in wing area on speed, economy and speed range.

For either a given lift coefficient or a given horse power, when the general effect of such alterations are thus known, the influence of other variables may be investigated from this starting point.

The chart, then, represents a series of airplanes, all having the same fuselage and the same engine but differing in wing area. In general, the total weight will depend upon the wing area. The horse power is considered to be varied by the thrust and variation of weight are not considered here for the reasons given above.

It will be seen, therefore, that the use of the chart is merely qualitative but, even so, by the choice of suitable data in its construction it can also be used to give accurate

enough quantitative information as to speed and economy on "light" planes.

As a basis from which to start, a plane similar to the 1925 Power-Lift I was chosen as a basis. The characteristics of such a plane are given below:

Horsepower—50
Top speed—61 m.p.h. or 105 ft. per sec.
Economy—35 miles per U. S. Gallon.
Wing area (on this particular plane)—78 sq. ft.
Fuselage weight and all weight added to wings—659 lb.
Wing weight at 1.0 lb. per sq. ft. — 78 lb.

Total weight 737 lb.
Wing Weight—8.34 lb. ft.
Data for the wing section were taken from Technical Note, NACA, No. 215, *High and Low Aspect Ratio Corrections* were made according to NACA Report No. 121.

A Practical Example

From these data, a value for the parasite resistance was estimated as secondary to the following:

We have for horizontal flight, Weight = Lift
or $W = L = \frac{1}{2} \rho V^2 C_L A$ (1)

or $C_L = \frac{W}{\frac{1}{2} \rho V^2 A}$

Where:
 V = Speed, ft. per sec.
 W = Total weight in lb.
 L = Lift in lb.
 S = Wing area in sq. ft.
 C_L = Absolute Lift Coefficient
 C_D = Absolute Drag Coefficient (wing)
 ρ = Standard density = 0.002378 slugs per cu. ft.
Putting in the values from above, $C_L = .109$ and, from the wing curve, the corresponding $C_D = .0053$.

The horsepower is given by:

$$P = \frac{\Delta V}{550} \quad (2)$$

Where H = Horsepower
 ΔV = Total drag of plane, lb.
 ΔV = Propeller efficiency
or $\Delta V = \frac{400 H}{550}$
If $H = 50$ or $\Delta V = 105.4$ ft. per sec.
When the value $H = 50$ and $V = 105$ are substituted

Further, we have:
Total Drag = Wing Drag + Parasite Drag
 $\Delta V = \frac{W}{\frac{1}{2} \rho V^2 C_L A} + \frac{1}{2} \rho V^2 C_D A$ (3)
Where C_L = Abs. Parasite Drag Coef.
 C_D = Normal Prop. Area Per Drag
and A is the summation of all the parasite drag areas with their respective drag coefficients.

The expression $\frac{W}{\frac{1}{2} \rho V^2 C_L A}$ for the parasite drag of an airplane is for more convenient and logical than the so-called "Equivalent square plate area" so frequently used. Substituting the value $C_L = .109$ and $S = 78$ sq. ft. and putting in the value of $\Delta V = 105.4$ ft. per sec.

$$\Delta V = \frac{W}{\frac{1}{2} \rho V^2 C_L A} + \frac{1}{2} \rho V^2 C_D A$$

The expression used for calculating the horsepower is based on the following:

Total weight = Wing weight, weight of all other parts

$$W = W_s + W_o \quad (4)$$

Putting in values $W = 106 + 209$ (5)

Where W_o = Weight of plane without wings
 A = Weight of wings in the per sq. ft.

$$\text{From (1) and (3)} \quad V = \sqrt{\frac{(106 + 209) \times 1.0}{\frac{1}{2} \rho C_L A}} \quad (6)$$

and $\Delta V = (C_L S + C_D S) 550 H$ also $H = \frac{\Delta V}{550}$

$$\text{From (4) and (5)} \quad H = \frac{(106 + 209)}{550} \times \frac{1}{C_L S + C_D S}$$

Combining (2), (3), and (4)

$$H = \frac{1}{550} \times \frac{(106 + 209)}{C_L S + C_D S} \times \frac{1}{\sqrt{\frac{(106 + 209) \times 1.0}{\frac{1}{2} \rho C_L A}}}$$

$$H = \frac{1}{550} \times \frac{(106 + 209)}{C_L S + C_D S} \times \frac{1}{\sqrt{\frac{(106 + 209) \times 1.0}{\frac{1}{2} \rho C_L A}}}$$

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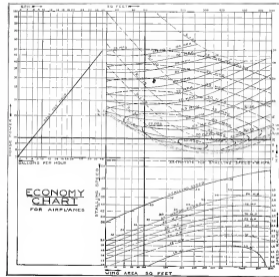
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Left Coeff. is found from:

$$\text{Miles per Gallon} = E = \frac{603 V}{\frac{G.H.}{32.2}} \quad \text{but from (2)} \quad E = \frac{T}{H} \quad \text{and} \quad \frac{G.H.}{32.2} = \frac{T}{H} \quad \text{and} \quad \frac{G.H.}{32.2} = \frac{T}{H}$$

$$\text{From (4)} \quad H = 375 h_2 \quad \text{and} \quad H = 375 h_1$$

$$E = \frac{G.W.(h_2 + 2h_1)}{0.7(W + H)(h_2 + 2h_1)} \quad \text{and} \quad \frac{G.W.}{0.7(W + H)} = \frac{E}{h_2 + 2h_1}$$

$$S = \sqrt{\frac{W(h_2 + 2h_1)}{A h_2}} \quad (4)$$

The following problems worked out by the chart will be able to demonstrate the use in showing the effect of variation of area with a given loadings.

(1) Given the horsepower = 11 = 20. What area is required for maximum miles per gallon. Area = 120 sq ft. Speed = 72 mph, $h_1 = 1.5$, the miles per gallon = 42; the speed range = 1.5, the sailing speed being 48 mph.

(2) A plane is to fly at a lift coeff. of $h_1 = 2$. Find the area which will give the most miles per gallon. Area = 285 sq ft., the horsepower = 33, the miles per gallon =

58 and the speed = 48 mph.

(3) Given an area of 150 sq ft. what horsepower is required for maximum miles per gallon. Area = 150 sq ft.; miles per gallon = 54; speed = 50 mph and $h_1 = 20$.

(4) For a given economy, say, 60 miles per gallon, what area gives the least horsepower. Area = 290 sq ft. and horsepower = 33.

(5) If the lift coeff. is taken as $h_1 = 25$, what area will be used to require the least horsepower in ft. Area = 250 sq ft., horsepower = 25, speed = 47 mph, and the miles per gallon = 50.

(6) If the horsepower is = 50, what area will give the maximum speed. Area = 118 sq ft., speed = 72 mph, and the $h_1 = 2$.

(7) For the given loadings under consideration and a wing area of 75 sq ft., what is the sailing speed. Area = 65 mph.

(8) For a given required economy of 60 miles per gallon, what area will give the highest speed. Area = 190 sq ft. and the speed = 78 mph.

(9) Given a horsepower of 25, what lift coeff. gives the greatest speed. Area = 39 and the speed = 60 mph.

(10) For a given constant area of 160 sq ft., what speed gives the greatest miles per gallon. Area = 50 mph, economy = 50 miles per gallon.

(11) Given a required economy of 50 miles per gallon, what is the smallest area we can use. Area = 96 sq ft.

(12) Given a required speed of 70 mph, what area gives the economy greatest. Area = 120 sq ft. and the miles per gallon = 45.

by the national board. The contract bond will be fixed at not less than \$500,000.

The national board will be required to provide necessary equipment and to land and take off all ships, to permit proper handling and distribution of funds by post office department employees.

Communications must against plans of other contractors on receiving lines to land and take off all ships on this route when such plans are actually engaged in transporting mails to or from the route.

Private contractors are now investigating and by air between various points in the United States, and the Post Office Department is well pleased with the performance.

With the most rapid of a contract for transportation of express by air, postal officials feel that commercial airlines is equally meeting a similar need and that coordinated operation of connecting lines by the Government would set a standard in the progress of private airlines in the air.

"For the Government to maintain in the field would mean the destruction of service, since it cannot carry express packages and passengers and would only serve to depress commercial companies at needed routes."

Portugal Plans Round-The-World Flight

The French-The-World Flight, which the Government of Portugal has planned to undertake, will begin early in January, 1927. The personnel, as selected to date, consists of Major de Barros, Lieut. Jose Calvo, Capt. Jorge de Gouveia and Lieut. Manuel de Gouveia. Major de Barros and Lieut. Gouveia will be accompanied by their respective wives from Lisbon to Madras, in 1927, and from Madras to Moscow, China, in 1928.

The flight will cover 45,000 kilometers, 3,100 of which will be over the Pacific Ocean. Twenty-eight stops will be made at the principal cities along the route. A complete, equipped with two Lawrence motors, will be used.

Lightplanes and Private Flying

Low Powered Flying As the Basis Upon Which Cheap Airplanes May Be Produced

THE realization of any new act, there is always a long and hard road to follow and it is not until the future and what comes or seems of success in the development is most likely to follow and what may be the eventual outcome. There is, therefore, every reason for giving thought to the possible future of the airplane and flying from the civil and commercial standpoint. This, in general, is a wide subject, being divided, as it is, into three very distinct branches, namely, air transportation, aerial service, and private flying and air touring. Each of these divisions represents a study within itself but they all, as a whole, concern the aircraft industry very vitally, since it is a generally accepted conclusion that in commercial and civil aviation very considerable property lies.

A Definition of Private Flying

At this time it is proposed to set down ready ideas on the possible future of private flying, without attempting in the least to state the ideas adopted or to claim any originality of thought on the subject. As private flying it is assumed that a full agreement to that of the private automobile owner is understood and that a private car of the future may be any one who possesses an airplane for his own personal knowledge and pleasure and that of his associates, without any intention of making money out of his ownership. A man, for example, who purchases an airplane to make him in getting about the country is granted as his regular business would be treated a private car just as much as would be so owner of an airplane which is used solely for flying for the pure pleasure of flying which is already the case in the automobile field and the business which limit the private possession of automobiles may be expected, also, to a somewhat more pronounced extent, to limit the ownership of private airplanes.

The cost of the automobile, like funds it has been reduced, by a very largely a factor tending to a more general ownership

of private automobiles. This fact may, incidentally, be recognized generally as a very great advantage since riding over the highways would be even less desirable than at present were it not so. Thus, it seems to prove one of the leading factors in the private ownership of airplanes, taking it for granted that, as it now almost universally the case in this country, every city of reasonable size is provided with a reasonably convenient airport.

There are on the market at the present time a number of very excellent airplanes in the world which suitable for private ownership which will not only be very reasonable prices, especially when it is recalled how comparatively young civil flying is. It is fully realized, however, that, in the same, the comparatively low price of these airplanes is rendered possible by the enormous surplus was produced in excess of low power which have been, and are still to be, limited extent, available. When the state of surplus engines are exhausted the selling price of these airplanes will come low or not up, depending entirely upon whether or not other airplane engines of low power are available at a price somewhat comparable with that of the present displaced engine. And that means somewhat difficult to view of the thoroughly low figures at which it has been possible to purchase displaced material.

Only last week, Aviation, in article on the comparative cost of airplane engines and power plants compared to other fields of traction, showed that designs in this manner have succeeded, in spite of the extremely specialized problems involved, in producing airplane engines which cost, per horsepower, no more than in other classes of power plants, and to many more and considerable loss. This would indicate that it is not to have cheap airplanes for private ownership, we must reduce the power required for flight in such planes in order to have the rest of the power plant drive. There is no doubt about it as to how the reduction that, under the present condition of aircraft production, we have been able to complete recently, is paid of selling price with less



A LOW POWERED PLANE. The Swift Motorplane 20-25 hp. which has such a good performance.

Air Mail Bids Asked on Two Routes

Postmaster General Nye on Nov. 15 invited proposals for the transportation of air mail, under contract, as follows: Chicago, Ill., via Iowa City and Des Moines, Iowa, Omaha and North Platte, Neb., Cheyenne and Salt Springs, Wyo., Salt Lake City, Utah, Reno and Reno, Nev., and Sacramento, Cal., to San Francisco, Cal., and return, a distance each way of 4,000 mi. The bids are receivable Nov. 15.

This action is intended to carry into effect the department's policy of establishing routes of low cost lines in some cases as established that private contractors were strong enough to receive their operations. Postal officials today reflected that the Government was not an operating agency, and that the inception of the line of transportation of mail by air there had been no intention of remaining in the transportation field.

Announcement was also made that the proposed new air-line of 30 miles a half mile for air mail, in all parts in the United States soon will be put into effect.

The contract for the mail line will be in two sections. The first will include the New York to Chicago leg of the transcontinental route and the overnight route between New York and Chicago, both of which run via Delaware, Pa., and Cleveland and Dayton, Ohio.

The second section will be the Chicago to San Francisco route, via Iowa City, Des Moines, Omaha, North Platte, Cheyenne, Salt Lake City, Reno and Sacramento.

The schedule will require an average flying speed of at least 50 m.p.h., with allowance for slower time for weather conditions. The stipulation of Nye is added to the fact that the Western section is in excess of 1,000 mi., the distance from Chicago to San Francisco by air line being 1,000 mi., and that contractors will be required to a minimum speed of 45 m.p.h. for the first 1,000 mi. and not exceeding 50 m.p.h. for the remainder 100 mi.

A bond of \$75,000 is required with the proposal and will be surrendered with the bond furnished under the contract.



Another view of the Avion Motorplane (Whitcomb 22-35 by speed)

power plants, then, when aircraft engines are sold in large quantities for civil purposes, the price will go down even further.

The lightplanes which have been produced in this country and abroad have varied in materials used, construction, engine type, flight, with a very satisfactory performance and even some reserve power, can be carried out on what we have here had to consider in very low prices. In England, very largely as a result of the reconstruction, the large civil planes offered by the Air Ministry and the Dutch, etc., that have passed flight has been developed and developed to a certain degree, as no very widely constructed in the last European competition held in Germany. The winning plane, the Heinkel Cypsel, carried 620 lb. of useful load (four persons more than the empty weight of the plane) with a total distance of 1901 miles, covered distance a series of flights at an average speed of 60 m.p.h. with a climb of 20,000 ft. per hour.

In this country, too, in spite of three long years no official encouragement and little or no competition, considerable progress in sports, low-powered flying has been made. Philadelphia, during the National Air Show this year, we saw several new excellent lightplanes, among which may be mentioned the Hawk Trainer (Chapin, Dayton, Ohio) (Hawk Trainer) and the Hawk Trainer (Chapin, Dayton, Ohio). Certainly one of the most interesting examples in the lightplane class built in this country and abroad, demonstrating the possibilities of low-powered flying, it is to be found in the Hawk Trainer, equipped with the Whitcomb development 30 hp. The Hawk Trainer may justly be described as one of the lightest planes in every respect of the form of total weight, including engine, is but 120 lb. and the Motorplane which has a development of 72 hp. in weight but 80 lb. The motor has never been fully described in America in the past. Its construction shows a maximum speed of 90 m.p.h. for the plane with a landing speed of 10 m.p.h. and a rate of climb, for the first minute, of 900 ft., with a ceiling of 25,000 ft. The Motorplane has a span of 30 ft. and no overall length of 14 ft.

A Practical Lightplane

This little machine has proved very successful and a really profitable business in every sense of the word. A second important may be cited in point. V. C. Wood, president of the Pacific Transport Company, was one of the company's earliest planes from Los Angeles to Portland, Ore. and landed at the Avion Airport, Sacramento, Cal. on route. In landing, one of the two Avion of the Avion Motorplane flew out and replaced the first one, which was completely out of order. Mr. Wood was in a hurry to continue the flight and the second

plane from which a spare was sent, he obtained was Marked 1212, 12 m.p.h. speed. Accordingly, the Motorplane was dispatched in a 40 m.p.h. speed to provide the spare was which it brought back to the side of the landing, landing back at Avion Airport, carrying several passengers and leaving for Seattle, leaving behind a crew and a spare.

In the development of this little plane, some of the problems which have been met with and overcome are of special interest. Firstly, in the matter of construction, standard parts were found too large for the machine and the manufacturer could not make a general standard without an order for a very large quantity. So the firm, Alvin Company, made its own construction for the Motorplane. Furthermore, the standard wheel and tire on the market was found too large for the little lightplane and upon its manufacture would produce the required size of wheel and tire without the assistance of its axle. For a quarter and, secondly, the 12 m.p.h. engine was required to obtain a variable mixture for the little Motorplane. This, too, had to be a special job and, third, with the result that the firm people are not only able to use a distributor, having the other parts and accessories they can assemble.

All these details were on an example of the stage which has been put into the development of the Motorplane for lightplane which has been produced in this country and an indicator of the indications with which this field of development work must be carried out. Such a machine must undoubtedly have a few defects. Their initial cost is not likely to be high, especially when large numbers of them are turned out and the volume of the lightplane is considerably less than the standard cost.

This new form of this machine will become regular in a matter of some months. Indeed, it will find its way into the line here in an important flying open this operation and results in a way not to be denied at least temporarily, in the formation of a club such as the Whitcomb Lightplane Club which has been formed at Whittier, Calif. by a group of enthusiasts, some of whom could afford no purchase of an Avion but who have had the use of the Club's plane. In this way, especially where the maintenance of the club's plane or where it is desired not to be members of the club, the cost of flying per hour is a member can be brought on low as from six to seven dollars, in addition, of course, in the usual case. There is little doubt that these clubs will spread and will cause the field for the production of light low-powered aircraft for private use, the production which will at first be restricted by the club and will eventually be brought in increasing numbers by private owners belonging to clubs in California.

Notes on Air Speed Indicators

Some Practical Information on the Most Used of Airplane Instruments

The following notes, relating to the use and maintenance of air speed indicators, have been supplied by the Pioneer Instrument Company, Brooklyn, N. Y., and are, in case of the first class, the air speed indicator is one of the most used of instruments in an airplane, fairly in proof of considerable practical value to all airplane operators.—KORSA.

AN AIR speed indicator is a sensitive differential pressure gauge. It indicates in terms of the speed in air travel, the pressure resulting from the flow of air past the Pitot-static tube to which it is connected.

The pitot-static tube consists of two separate tubes one of which has an open end which receives the full impact of the moving air. The other tube is closed at its forward end and has small holes at short nose distance back from the end. These openings to the interior of the tube the static pressure which may be used as long that the static pressure in the air where the indicator is located. Some pitot-static tubes made with the pitot and static ports concentric so that they appear as one tube. Any properly made pitot-static tube can be used with any pitot tube air speed indicator, its indication or adjustment being required.



The open end (Pitot) and static tube of an air speed indicator

The air speed indicator has two parts main. The first is an "indicating member." The object of this member is to show the velocity and density of the air passing under its wings. The indicated air speed being a function of height and density, this instrument serves to measure the support or lift of the airplane. The readings of an air speed indicator are correct in terms of true speed only in air level. At higher elevations the readings are less than the actual speed due to the decrease of the air. The support is not affected from the air decreases with its density, however, the indicator continues to be a correct measure of this support. In other words, if the actual speed of an airplane in any level is 40 m.p.h., it will read 40 m.p.h. at an indicated speed of 40 m.p.h. in spite of the fact that the actual speed may be much more. Related to its function as a support indicator, the air speed meter becomes an indicator of the forward air pressure of the airplane when combined in conjunction with the Tachometer. For a given engine speed, there is a certain air speed corresponding to level flight. If the air speed reading increases, it indicates that the airplane is descending. If the air speed reading decreases, it indicates that the airplane is climbing.

The second use for the air speed indicator is as a correction instrument. When in conjunction with the flow of lift and corrected for wind and altitude error, the air speed indicator enables a pilot to keep more check upon the distance he is traveling.

The air speed indicator is installed on an instrument board in the same way as any other instrument. Care must be taken

to see that the controls near to each position that connecting tubes can be brought to them conveniently. It is also desirable that the indicator be mounted close to the instrument, so these two instruments are used together in obtaining forward-air distance.

The pitot-static tube on a conventional airplane of the biplane type should be installed about two-thirds of the way down from the top plane on a wire strand which is well clear of the propeller tip. On extremely low wing examples, a suitable place may usually be found on a wing strut. On unusually low-winged examples it is possible to install the pitot-static tube mounting from two to four feet ahead of the wing, or from 15 to 24 in. below it, to make a position of installation.

Metal Tubes Recommended

The connections between the pitot-static tube and the indicator should be made with metal tubing. Copper tubing of 1/16 in. outside diameter is recommended. At the forward point in the connecting tubes, pressure should be made for a down speed "7" fittings are supplied with 1/16 in. pressure or speed indicator. The connecting tubes are attached to two tubes of the "7" and the third which is closed with a speed cup which serves as a very convenient device. In the connecting tube should preferably be made with additional metal fittings. If rubber fitting is used, great care must be taken to see that the work is perfectly tight.

The connections of the pitot-static tube and indicator are made P (pressure) and S (static) and can now be taken to see that the fitting meets between the indicated connections.

An air speed indicator connected with colored metal fittings requires no alteration except the periodic removal of the cap from each metal fitting, and the diameter of the same which may have some alteration. Lubricants connected with rubber tubing should be carefully inspected at intervals of not longer than six weeks and the rubber tubing replaced is a determination.

More air speed indicators are designed to long lasting into air speed used in any other way. The pressure or static indicator required to secure an indication of 700 m.p.h. may read six inches of water pressure. An indicator person can



The Air of a Pioneer air speed indicator

PICTURES IN THE NEWS



(Above)
AN AERIAL FLUTTERFLY—A view of Vespene Deltas flying in steep up-and-down formation at San Diego, Cal.



(Above)
PWA DELIVERY IN AIR—The famous French Star, Lusitania, being delivered to Paris in the French mail service in its dropped by parachute in the laboratory at Mont St. Michel.



(Above)
LONG-POWER TO-REWE—Barred Leth and Mandy Stock on the DM 30th (Cairo 50 ft.) by the same Lusitania Star 15 for take and probable A. 30th in December, the first of the first flying.



(Above and right)
PRINCE TO PUT TWO CASQUES—The Prince of Wales (Prince of Wales) is seen in the French long distance flight which took place recently. The first part of the game is a very excellent shot of the machine employed at during the necessary game of the only surrounding the body of the machine.



(Above)
THE AIRMAN'S LIVES—A picture taken from the cockpit of the plane showing the man, who is out of the plane.



(Left)
STUDY GOES TOO—The Navy's Pacific and Atlantic Flying Squadron No. 1, Second Fleet under the command of Lord C. 10, Navy U.S.N., has flown in the air a new 100,000 miles with a single, fixed land. Their operations have been in California, New York, Michigan, Pa., and Newport N. J., and finally the Squadron moved to the previously mentioned flight with the Squadron.



(Above)
A Navy Landing Amphibian—A picture taken from the cockpit of the plane showing the man, who is out of the plane.

The Richard-Penhoet Giant Flying Boat

A New Giant Five Engine Flying Boat Built in France.

A FRENCH designer, T. A. Richard, conceived in 1920 a giant flying boat. After many preliminary studies, the boat was completed and was put through its flight tests in September of this year. The plane has with a gross weight of over 35,000 lb., or more than twice the weight of a D.H. The machine is a monoplaner with a wing built into an enormous hull. Two 625 hp. semi-closed radial Jupiter engines are carried in the leading edge of the wing on each side with a 3250 engine in set in the bow of the hull. The total power is thus 3,100 hp., making the machine one of the largest flyingboats ever built. No official information concerning the flight tests have been issued and all that is known is that the boat has been in the air for several hours.

The wing spans of the plane is 124 ft. 2 in.; the maximum chord is 39 ft. 6 in.; with the maximum chord, 18 ft. 5 in.; the maximum wing thickness is 5 ft. 10 in. These figures give some idea of the enormous size of the plane.

The wing has four main spars built of wood reinforced with steel. They are thick spars and appear to be of the box type of construction, with very large oval holes in the webs to lighten the structure. The spars are 4 ft. 10 in. apart. There are also three thin spars between the main spars. The covering is of fabric, except behind the engine where duralumin is used. The wings were designed for a safety factor of 8 and have withstood a test load corresponding to a load of 10,000 lb. for the plane. The stresses are at maximum length and are balanced by two sets of jacking cables both above and below the main spar. The wing section is Eiffel No. 396, a characteristic of which is its small moment of the center of pressure. The section has been slightly modified to conform to the requirements of structural strength.

The Hull and Cabin

The hull of the Richard-Penhoet flyingboat is 80 ft. 10 in. long, 16 ft. 4 in. high, 25 ft. 3 in. wide. There is a double bottom and the hull is divided by eight transverse bulkheads. There is only one step and, as this is built up separately, it can easily be removed in case of damage. The hull structure covering extends from a distance of 200 in. to the tail as is made of a plywood of spruce, birch and oak. As in the wings, there is a considerable amount of steel construction incorporated in the hull. The cabin is placed under the wing and has seating capacity for twenty passengers. The pilot and navigator sit up in a cockpit which is built in above the wing. The wing tip floats are 5 ft. long.

The five Jupiter engines are accessible from the rear door. Right for the wings have over 5 ft. thick, affording easy passage way. There are eight tanks of 120 gal. capacity each, with six more reserve tanks of 100 gal. full capacity. The tanks are set in the wings and can be refilled in case of necessity in 30 sec.

The outstanding problem involved in the construction of a plane of this size are very considerable especially when the

matter of the central section is studied. The fixed portion of the inclined stabilizer on the Richard-Penhoet is larger by a considerable extent than the whole area of the Waco & while the elevator is about the size of the lower wing of a Waco. To get these areas balanced, so that they can be handled by the pilot is a very complicated task. The main aileron stabilizer has an area of 154 sq. ft. and the elevator an area of 117 sq. ft. The vertical fin is comparatively small, having an area of only 45 sq. ft., while the rudder has 74 sq. ft.

Servo Motor Control

The boat is fitted with dual controls which can be operated either by hand or by a hydro electric servo motor. The ailerons and elevator are balanced by pulleys. An air starter is used to start the engines. The motor and the gasoline engines are electrically operated. Five retractable-gear operation, which can be operated either by hand or automatically, is part of the equipment. Radio with a range of 500 miles, is part of the equipment of the plane. The crew consists of two pilots, a navigator and a mechanic.

The weight of the plane is 23,500 lb. and the weight loaded 35,000 lb. which gives a useful load of 11,500 lb. The wing area is 2,850 sq. ft. and the total power, as already stated, 3,100 hp., giving loadings of 11.2 lb. per sq. ft. and 15.5 lb. per hp.

The boat was designed for service over the Mediterranean between France and Africa. Several longer types have been projected for service between Africa and South America but the present type will probably have to be experimental with a considerable extent before longer boats are built. Experimental aircraft, as a rule, cost at least \$150,000 a piece and often more, so that this one giant flying boat must have cost in the neighborhood of \$500,000.

International Commission of Air Navigation Meets

The International Commission of Air Navigation held its seventh session in Paris during November, 1936, with twenty-two nations represented. The United States, which had no official observer at previous meetings of the Commission, was not represented this year.

Among important decisions taken at the Commission were the following: Action regarding the procedure of technical inspection upon aircraft according to current flight regulations; simplifying the international model of the "current day" (current permit) for aircraft; remodeling requirements to be met by candidates for navigator's license; preparing for the projected Washington radio-telegraph conference of 1937, an outline of proposals relative to the use of wireless in air navigation.

The twelfth session of the Commission will be held in April, 1937, at either Lisbon or London.

The giant Richard-Penhoet machine (shown) (the 42 hp. Jupiter engine)



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TO THE EDITOR:

Many aircraft designers begin to find that, because of the need for lightening through the wing ribs to bring the aircraft into a lighter weight of construction.

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Air Corps Tests Times by Moving Pictures

A series of drop tests, ranging in height from three to thirty miles, have been made at the national defense, the Coast Field, to determine to what extent airplanes have ability to land. The drops were made with three standard test cases, 20 x 2, 20 x 2, and 20 x 2, the last carrying from 2,000 lb. on the 20 x 2 to 2,000 lb. on the larger size.

The results were studied by means of slow motion pictures, the picture definitely showing the energy absorbed by the case to be from 15 to 20 per cent of the load, with standard air pressure. Similar test will be made on an also landing gear test, with and without the tire and shock.

Crispy Field Improved

Continuous effort and work for the past two years has improved the landing field at Crissy Field, Pointa de San Francisco, Calif., considerably. Although there is a slight bank, the runway in the total length of the field and, thanks to the excellent drainage network, planes can land and take off regardless of the surface. The flying field is now 3,000 ft. long by 400 ft. wide and has been resurfaced, retiled and planted with grass.

Crescent City, Cal. to be Naval Air Base

By G. K. Jones

The engineering staff of the Aircraft Signal Corps of the Navy has just received two General Ampleman directly with orders to prepare a complete map of the Crescent City, Cal., district, preparatory to the establishment in that location of a combined Naval aviation base.



Crescent City, Cal., where a Naval base will be established.

The department of the plans and their operations will be under the direction of Comdr. Karl Smith, Engineering Officer of the Aircraft Signal Corps of the Battle Fleet, and the operations will be directed by the field by Lt. Col. Wm. H. Wink, U. S. N., who will take with him previously the standard one he commanded in the mapping of the Alaskan Alaskan test summer. The Naval operations will be in later weeks.

This represents the first important Naval aviation extension in the Pacific since the War, and is one of the latest forward moves in Naval aviation under the Assistant Secretary for Air in the Navy Department.

According to Lt. Col. F. D. Dunsen, of the engineering staff of the Aircraft Signal Corps, it is the intention of the air forces to establish such bases and personnel, as the standard day from the San Diego Coast, as well as being used to maintain the field in an operating status, and provide an airport for all military aircraft moving northwest on the strength between San Francisco and the Coast. In time of war, a portion of the assets in the northwest would be re-located out of the sea base. The problem is also to have suitable features for a submarine base and a complete system of refuge for supplies and to land supplies.

From the sea, the situation at Crescent City is completely altered to offer a strategic advantage, in particular to naval defense, to the Navy submarine and its return at Vancou, in the Western Islands. It is because of the strategic advantage for submarine and its operations, as well as the point for particularly half-way between the two present locations, the base of the Navy, that the first air command, according to Lieutenant Dunsen, is necessary to complete the work.

It was originally intended to complete the Crescent City mapping in part of the Alaska test, but because of the weather conditions, it was decided to complete the work, but needed more on the way to the main base of the department at Crescent City, to enter the line of all the equipment, and then constructing a permanent expedition this winter.

Planes Leave Warships in Storm Battle at Night

Six destroyers and six submarines of the Navy recently attempted to force an unopposed entrance to San Francisco Harbor. The first of the destroyers, the USS, and the first of the submarines, the USS, were the first to enter. The first of the destroyers, the USS, and the first of the submarines, the USS, were the first to enter.

The question of destroyers was discussed by means of possible force and they were pushed up by the harbor force, which were present also across the problem. General two-way radio communication was maintained.

Master Sergeant Thomas J. Finkbe, pilot, and Sergeant H. B. Kewell, observer, were assigned as the pilot, and the first of the destroyers, the USS, and the first of the submarines, the USS, were the first to enter.

Color of Navy Planes to Match Ship

New steelhuller color has been assigned all planes of the landing division. The color of the hullings and the surface of all planes has been painted in other colors, in accordance with the color of the tops of the hulls of the ship to which the planes is assigned. The new uniforms of the planes extended to Japanese destroyers are painted the color and follow the outline of the hulls of the ship.

In addition to the ship, the second part of the new uniforms of all planes is painted in other colors. These are painted red, of battleship destroyers, four colors, and battleship destroyers five colors. The third of the new uniforms of all planes is painted the color of the hulls of the ship.

It is believed that this scheme of identification will prove of great advantage both between planes in the air and between surface ships and aircraft.

Clear for Lighter-than-Air Flying Starts Feb. 15

The Navy Department has announced that a class of eight officers will be recruited at the Naval Air Station, Lemoore, N. J., on Jan. 15, 1937, for training in lighter-than-air craft. The class will probably consist of two first lieutenants, two lieutenants and four lieutenants (junior) or subalterns. Applications have been requested from officers throughout the service.

Applicants will be required to pass a physical and psychological examination given by a naval medical officer on duty in civilian service. Only those officers who have successfully passed the physical and psychological examination within the six months immediately preceding Feb. 15, 1937, will be considered for assignment to this training class.



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G1-10-20-30-40-50-60-70-80-90-100-110-120-130-140-150-160-170-180-190-200-210-220-230-240-250-260-270-280-290-300-310-320-330-340-350-360-370-380-390-400-410-420-430-440-450-460-470-480-490-500-510-520-530-540-550-560-570-580-590-600-610-620-630-640-650-660-670-680-690-700-710-720-730-740-750-760-770-780-790-800-810-820-830-840-850-860-870-880-890-900-910-920-930-940-950-960-970-980-990-1000-1010-1020-1030-1040-1050-1060-1070-1080-1090-1100-1110-1120-1130-1140-1150-1160-1170-1180-1190-1200-1210-1220-1230-1240-1250-1260-1270-1280-1290-1300-1310-1320-1330-1340-1350-1360-1370-1380-1390-1400-1410-1420-1430-1440-1450-1460-1470-1480-1490-1500-1510-1520-1530-1540-1550-1560-1570-1580-1590-1600-1610-1620-1630-1640-1650-1660-1670-1680-1690-1700-1710-1720-1730-1740-1750-1760-1770-1780-1790-1800-1810-1820-1830-1840-1850-1860-1870-1880-1890-1900-1910-1920-1930-1940-1950-1960-1970-1980-1990-2000-2010-2020-2030-2040-2050-2060-2070-2080-2090-2100-2110-2120-2130-2140-2150-2160-2170-2180-2190-2200-2210-2220-2230-2240-2250-2260-2270-2280-2290-2300-2310-2320-2330-2340-2350-2360-2370-2380-2390-2400-2410-2420-2430-2440-2450-2460-2470-2480-2490-2500-2510-2520-2530-2540-2550-2560-2570-2580-2590-2600-2610-2620-2630-2640-2650-2660-2670-2680-2690-2700-2710-2720-2730-2740-2750-2760-2770-2780-2790-2800-2810-2820-2830-2840-2850-2860-2870-2880-2890-2900-2910-2920-2930-2940-2950-2960-2970-2980-2990-3000-3010-3020-3030-3040-3050-3060-3070-3080-3090-3100-3110-3120-3130-3140-3150-3160-3170-3180-3190-3200-3210-3220-3230-3240-3250-3260-3270-3280-3290-3300-3310-3320-3330-3340-3350-3360-3370-3380-3390-3400-3410-3420-3430-3440-3450-3460-3470-3480-3490-3500-3510-3520-3530-3540-3550-3560-3570-3580-3590-3600-3610-3620-3630-3640-3650-3660-3670-3680-3690-3700-3710-3720-3730-3740-3750-3760-3770-3780-3790-3800-3810-3820-3830-3840-3850-3860-3870-3880-3890-3900-3910-3920-3930-3940-3950-3960-3970-3980-3990-4000-4010-4020-4030-4040-4050-4060-4070-4080-4090-4100-4110-4120-4130-4140-4150-4160-4170-4180-4190-4200-4210-4220-4230-4240-4250-4260-4270-4280-4290-4300-4310-4320-4330-4340-4350-4360-4370-4380-4390-4400-4410-4420-4430-4440-4450-4460-4470-4480-4490-4500-4510-4520-4530-4540-4550-4560-4570-4580-4590-4600-4610-4620-4630-4640-4650-4660-4670-4680-4690-4700-4710-4720-4730-4740-4750-4760-4770-4780-4790-4800-4810-4820-4830-4840-4850-4860-4870-4880-4890-4900-4910-4920-4930-4940-4950-4960-4970-4980-4990-5000-5010-5020-5030-5040-5050-5060-5070-5080-5090-5100-5110-5120-5130-5140-5150-5160-5170-5180-5190-5200-5210-5220-5230-5240-5250-5260-5270-5280-5290-5300-5310-5320-5330-5340-5350-5360-5370-5380-5390-5400-5410-5420-5430-5440-5450-5460-5470-5480-5490-5500-5510-5520-5530-5540-5550-5560-5570-5580-5590-5600-5610-5620-5630-5640-5650-5660-5670-5680-5690-5700-5710-5720-5730-5740-5750-5760-5770-5780-5790-5800-5810-5820-5830-5840-5850-5860-5870-5880-5890-5900-5910-5920-5930-5940-5950-5960-5970-5980-5990-6000-6010-6020-6030-6040-6050-6060-6070-6080-6090-6100-6110-6120-6130-6140-6150-6160-6170-6180-6190-6200-6210-6220-6230-6240-6250-6260-6270-6280-6290-6300-6310-6320-6330-6340-6350-6360-6370-6380-6390-6400-6410-6420-6430-6440-6450-6460-6470-6480-6490-6500-6510-6520-6530-6540-6550-6560-6570-6580-6590-6600-6610-6620-6630-6640-6650-6660-6670-6680-6690-6700-6710-6720-6730-6740-6750-6760-6770-6780-6790-6800-6810-6820-6830-6840-6850-6860-6870-6880-6890-6900-6910-6920-6930-6940-6950-6960-6970-6980-6990-7000-7010-7020-7030-7040-7050-7060-7070-7080-7090-7100-7110-7120-7130-7140-7150-7160-7170-7180-7190-7200-7210-7220-7230-7240-7250-7260-7270-7280-7290-7300-7310-7320-7330-7340-7350-7360-7370-7380-7390-7400-7410-7420-7430-7440-7450-7460-7470-7480-7490-7500-7510-7520-7530-7540-7550-7560-7570-7580-7590-7600-7610-7620-7630-7640-7650-7660-7670-7680-7690-7700-7710-7720-7730-7740-7750-7760-7770-7780-7790-7800-7810-7820-7830-7840-7850-7860-7870-7880-7890-7900-7910-7920-7930-7940-7950-7960-7970-7980-7990-8000-8010-8020-8030-8040-8050-8060-8070-8080-8090-8100-8110-8120-8130-8140-8150-8160-8170-8180-8190-8200-8210-8220-8230-8240-8250-8260-8270-8280-8290-8300-8310-8320-8330-8340-8350-8360-8370-8380-8390-8400-8410-8420-8430-8440-8450-8460-8470-8480-8490-8500-8510-8520-8530-8540-8550-8560-8570-8580-8590-8600-8610-8620-8630-8640-8650-8660-8670-8680-8690-8700-8710-8720-8730-8740-8750-8760-8770-8780-8790-8800-8810-8820-8830-8840-8850-8860-8870-8880-8890-8900-8910-8920-8930-8940-8950-8960-8970-8980-8990-9000-9010-9020-9030-9040-9050-9060-9070-9080-9090-9100-9110-9120-9130-9140-9150-9160-9170-9180-9190-9200-9210-9220-9230-9240-9250-9260-9270-9280-9290-9300-9310-9320-9330-9340-9350-9360-9370-9380-9390-9400-9410-9420-9430-9440-9450-9460-9470-9480-9490-9500-9510-9520-9530-9540-9550-9560-9570-9580-9590-9600-9610-9620-9630-9640-9650-9660-9670-9680-9690-9700-9710-9720-9730-9740-9750-9760-9770-9780-9790-9800-9810-9820-9830-9840-9850-9860-9870-9880-9890-9900-9910-9920-9930-9940-9950-9960-9970-9980-9990-10000-10010-10020-10030-10040-10050-10060-10070-10080-10090-10100-10110-10120-10130-10140-10150-10160-10170-10180-10190-10200-10210-10220-10230-10240-10250-10260-10270-10280-10290-10300-10310-10320-10330-10340-10350-10360-10370-10380-10390-10400-10410-10420-10430-10440-10450-10460-10470-10480-10490-10500-10510-10520-10530-10540-10550-10560-10570-10580-10590-10600-10610-10620-10630-10640-10650-10660-10670-10680-10690-10700-10710-10720-10730-10740-10750-10760-10770-10780-10790-10800-10810-10820-10830-10840-10850-10860-10870-10880-10890-10900-10910-10920-10930-10940-10950-10960-10970-10980-10990-11000-11010-11020-11030-11040-11050-11060-11070-11080-11090-11100-11110-11120-11130-11140-11150-11160-11170-11180-11190-11200-11210-11220-11230-11240-11250-11260-11270-11280-11290-11300-11310-11320-11330-11340-11350-11360-11370-11380-11390-11400-11410-11420-11430-11440-11450-11460-11470-11480-11490-11500-11510-11520-11530-11540-11550-11560-11570-11580-11590-11600-11610-11620-11630-11640-11650-11660-11670-11680-11690-11700-11710-11720-11730-11740-11750-11760-11770-11780-11790-11800-11810-11820-11830-11840-11850-11860-11870-11880-11890-11900-11910-11920-11930-11940-11950-11960-11970-11980-11990-12000-12010-12020-12030-12040-12050-12060-12070-12080-12090-12100-12110-12120-12130-12140-12150-12160-12170-12180-12190-12200-12210-12220-12230-12240-12250-12260-12270-12280-12290-12300-12310-12320-12330-12340-12350-12360-12370-12380-12390-12400-12410-12420-12430-12440-12450-12460-12470-12480-12490-12500-12510-12520-12530-12540-12550-12560-12570-12580-12590-12600-12610-12620-12630-12640-12650-12660-12670-12680-12690-12700-12710-12720-12730-12740-12750-12760-12770-12780-12790-12800-12810-12820-12830-12840-12850-12860-12870-12880-12890-12900-12910-12920-12930-12940-12950-12960-12970-12980-12990-13000-13010-13020-13030-13040-13050-13060-13070-13080-13090-13100-13110-13120-13130-13140-13150-13160-13170-13180-13190-13200-13210-13220-13230-13240-13250-13260-13270-13280-13290-13300-13310-13320-13330-13340-13350-13360-13370-13380-13390-13400-13410-13420-13430-13440-13450-13460-13470-13480-13490-13500-13510-13520-13530-13540-13550-13560-13570-13580-13590-13600-13610-13620-13630-13640-13650-13660-13670-13680-13690-13700-13710-13720-13730-13740-13750-13760-13770-13780-13790-13800-13810-13820-13830-13840-13850-13860-13870-13880-13890-13900-13910-13920-13930-13940-13950-13960-13970-13980-13990-14000-14010-14020-14030-14040-14050-14060-14070-14080-14090-14100-14110-14120-14130-14140-14150-14160-14170-14180-14190-14200-14210-14220-14230-14240-14250-14260-14270-14280-14290-14300-14310-14320-14330-14340-14350-14360-14370-14380-14390-14400-14410-14420-14430-14440-14450-14460-14470-14480-14490-14500-14510-14520-14530-14540-14550-14560-14570-14580-14590-14600-14610-14620-14630-14640-14650-14660-14670-14680-14690-14700-14710-14720-14730-14740-14750-14760-14770-14780-14790-14800-14810-14820-14830-14840-14850-14860-14870-14880-14890-14900-14910-14920-14930-14940-14950-14960-14970-14980-14990-15000-15010-15020-15030-15040-15050-15060-15070-15080-15090-15100-15110-15120-15130-15140-15150-15160-15170-15180-15190-15200-15210-15220-15230-15240-15250-15260-15270-15280-15290-15300-15310-15320-15330-15340-15350-15360-15370-15380-15390-15400-15410-15420-15430-15440-15450-15460-15470-15480-15490-15500-15510-15520-15530-15540-15550-15560-15570-15580-15590-15600-15610-15620-15630-15640-15650-15660-15670-15680-15690-15700-15710-15720-15730-15740-15750-15760-15770-15780-15790-15800-15810-15820-15830-15840-15850-15860-15870-15880-15890-15900-15910-15920-15930-15940-15950-15960-15970-15980-15990-16000-16010-16020-16030-16040-16050-16060-16070-16080-16090-16100-16110-16120-16130-16140-16150-16160-16170-16180-16190-16200-16210-16220-16230-16240-16250-16260-16270-16280-16290-16300-16310-16320-16330-16340-16350-16360-16370-16380-16390-16400-16410-16420-16430-16440-16450-16460-16470-16480-16490-16500-16510-16520-16530-16540-16550-16560-16570-16580-16590-16600-16610-16620-16630-16640-16650-16660-16670-16680-16690-16700-16710-16720-16730-16740-16750-16760-16770-16780-16790-16800-16810-16820-16830-16840-16850-16860-16870-16880-16890-16900-16910-16920-16930-16940-16950-16960-16970-16980-16990-17000-17010-17020-17030-17040-17050-17060-17070-17080-17090-17100-17110-17120-17130-17140-17150-17160-17170-17180-17190-17200-17210-17220-17230-17240-17250-17260-17270-17280-17290-17300-17310-17320-17330-17340-17350-17360-17370-17380-17390-17400-17410-17420-17430-17440-17450-17460-17470-17480-17490-17500-17510-17520-17530-17540-17550-17560-17570-17580-17590-17600-17610-17620-17630-17640-17650-17660-17670-17680-17690-17700-17710-17720-17730-17740-17750-17760-17770-17780-17790-17800-17810-17820-17830-17840-17850-17860-17870-17880-17890-17900-17910-17920-17930-17940-17950-17960-17970-17980-17990-18000-18010-18020-18030-18040-18050-18060-18070-18080-18090-18100-18110-18120-18130-18140-18150-18160-18170-18180-18190-18200-18210-18220-18230-18240-18250-18260-18270-18280-18290-18300-18310-18320-18330-18340-18350-18360-18370-18380-18390-18400-18410-18420-18430-18440-18450-18460-18470-18480-18490-18500-18510-18520-18530-18540-18550-18560-18570-18580-18590-18600-18610-18620-18630-18640-18650-18660-18670-18680-18690-18700-18710-18720-18730-18740-18750-18760-18770-18780-18790-18800-18810-18820-18830-18840-18850-18860-18870-18880-18890-18900-18910-18920-18930-18940-18950-18960-18970-18980-18990-19000-19010-19020-19030-19040-19050-19060-19070-19080-19090-19100-19110-19120-19130-19140-19150-19160-19170-19180-19190-19200-19210-19220-19230-19240-19250-19260-19270-19280-19290-19300-19310-19320-19330-19340-19350-19360-19370-19380-19390-19400-19410-19420-19430-19440-19450-19460-19470-19480-19490-19500-19510-19520-19530-19540-19550-19560-19570-19580-19590-19600-19610-19620-19630-19640-19650-19660-19670-19680-19690-19700-19710-19720-19730-19740-19750-19760-19770-19780-19790-19800-19810-19820-19830-19840-19850-19860-19870-19880-19890-19900-19910-19920-19930-19940-19950-19960-19970-19980-19990-20000-20010-20020-20030-20040-20050-20060-20070-20080-20090-20100-20110-20120-20130-20140-20150-20160-20170-20180-20190-20200-20210-20220-20230-20240-20250-20260-20270-20280-20290-20300-20310-20320-20330-20340-20350-20360-20370-20380-20390-20400-20410-20420-20430-20440-20450-20460-20470-20480-20490-20500-20510-20520-2

THE SCHNEIDER CUP RACE



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Curtiss-Reed Propeller (Reed Design)



700 H.P. CURTISS RACING
SEAPLANE
Curtiss-Reed Propeller



400 H.P. CURTISS SERVICE PURSUIT
Curtiss-Reed Propeller

CURTISS-REED PROPELLERS

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